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REDESCRIPTION AND LECTOTYPE DESIGNATION OF THE TESSELLATED SCALE, *EUCALYMNATUS TESSELLATUS* (SIGNORET) (HOMOPTERA: COCCIDAE)[1]

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Abstract.—A lectotype is designated for the tessellated scale, *Eucalymnatus tessellatus* (Signoret). The three immature instars and the adult female are described and illustrated, and a key for the separation of all instars is presented.

The tessellated scale, *Eucalymnatus tessellatus* (Signoret, 1873), is primarily a leaf-infesting soft scale and a greenhouse pest. In Florida, infestations of the tessellated scale are often of economic importance in commercial nurseries whenever pest management practices are neglected (Dekle, 1973). It occurs most commonly on palms but has been found on a wide range of host plants (Riddick, 1955). Borchsenius (1957) suggested that *E. tessellatus* probably originated in South America and was disseminated by man to all parts of the world on its cultivated hosts.

Much confusion has resulted from attempts to identify immature or young adult female specimens of *E. tessellatus*. The immature stages were previously undescribed and easily confused with members of the genus *Coccus*. Some authors (Kirkaldy, 1902; Steinweden, 1929) went so far as to include the tessellated scale in the genus *Coccus* because of the similarity of the younger stages.

Because of its economic importance and uncertain relationship with the genus *Coccus*, a morphological study of *E. tessellatus* was initiated. Here presented are a redescription and illustration of the adult female and descriptions and illustrations of three immature instars of *E. tessellatus*. Males are unknown.

[1] Part of a thesis submitted by the first author to the Graduate School of Auburn University in partial fulfillment of the M.S. degree requirements.

Terminology employed in the descriptions is mainly after Williams and Kosztarab (1972). Measurements (based on ten specimens) are given in microns and presented in the text as an average followed by the range in parentheses. In the material studied, detailed collection data are given for the type-series of the species. Additional records include only the locality, host plant, and depository of the material studied. The study is based on material from the National Museum of Natural History Coccoidea Collection, Beltsville, Maryland (USNM), the Auburn University Coccoidea Collection, Auburn University, Alabama (AU), and Naturhistorishes Museum, Vienna, Austria (NMVA).

Eucalymnatus tessellatus (Signoret)

Lecanium tessellatum Signoret, 1873: 401; Douglas, 1886: 77; 1887: 25; Cockerell, 1893: 51; 1894a: 19; 1894b: 73; 1894c: 312; Newstead, 1894: 234; Cockerell and Parrott, 1899: 229; King, 1899: 254; 1901: 312; Green, 1904a: 205; 1907: 197.

Lecanium perforatum Newstead, 1894: 233; 1897: 75; Cockerell, 1895: 257; King, 1901: 312; Thro, 1903: 212; Tullgreen, 1906: 91; Green, 1907: 197; Costa Lima, 1923: 35.

Lecanium tessellatum var. *swainsonae* Cockerell, 1897a: 109; 1897b: 90; Cockerell and Parrott, 1899: 229.

Lecanium tessellatum var. *perforatum* Cockerell, 1897b: 90; Quaintance, 1897: 91; Cockerell and Parrott, 1899: 229; Green, 1904a: 207.

Lecanium (*Eucalymnatus*) *tessellatum* Signoret, Cockerell and Parrott, 1901: 57; Green, 1904b: 206; Newstead, 1917: 130.

Eucalymnatus tessellatus (Signoret), Cockerell, 1902: 452; Fernald, 1903: 166; Sanders, 1909: 435; Dietz and Morrison, 1916: 243; Bodkin, 1917: 108; Lawson, 1917: 186; Costa Lima, 1923: 35; Hall, 1923: 55; Hollinger, 1923: 41; Merrill and Chaffin, 1923: 260; Trimble, 1925: 6; 1928: 44; Ballou, 1926: 23; Essig, 1926: 300; 1958: 300; Leonard, 1926: 196; Takahashi, 1928: 343; 1929: 56; 1939: 262; Lizer y Trelles, 1937: 352; Lindinger, 1935: 138; 1943: 147; Mamet, 1943: 152; 1949: 26; 1952: 171; Wolcott, 1948: 170; Zimmerman, 1948: 318; Borchsenius, 1950: 146; 1957: 306; Ebeling, 1950: 679; Schmutterer, 1952: 551; Bodenheimer, 1953: 94; Merrill, 1953: 94; Riddick, 1955: 3; Simmonds, 1957: 8; Metcalf, Flint, and Metcalf, 1962: 869; De Lotto, 1965: 193; Beardsley, 1966: 487; Ezzat and Hussein, 1967: 397; Avidov and Harpaz, 1969: 164; Nur, 1971: 305; Dekle, 1973: 1; 1974: 1; Koteja, 1974: 249; Kozarzhevskaya and Reitzel, 1975: 5; Gill, Nakahara, and Williams, 1977: 11.

Coccus tessellatum (Signoret), Kirkaldy, 1902: 106; Steinweden, 1929: 202.

Lecanium subtessellatum Green, 1904a: 206; 1907: 197; Costa Lima, 1923: 35.

Eucalymnatus perforatus (Newstead), Fernald, 1903: 166; Essig, 1913: 113; Bodkin, 1917: 108.

Eucalymnatus tessellatus swainsonae (Cockerell), Fernald, 1903: 167; Costa Lima, 1923: 35.

Lecanium (*Eucalymnatus*) *perforatum* Newstead, Pettit and McDaniel, 1920: 18.

Lecanium tessellatum obsoletum Green, 1922: 1024.

Lecanium tesselatum obsoletum Green, Ramakrishna Aiyar, 1926: 454.

Lecanium tesselatum Signoret, Ramakrishna Aiyar, 1926: 454.

Eucalymnatus tesselatus (Signoret), Balachowsky, 1927: 185; 1938: 257.

Type material.—Through the courtesy of Dr. A. Kaltenback of the Naturhistorishes Museum, Vienna, Austria, the authors have received for study dry material of three fully-grown adult females and several immature soft scale insects labelled "*tesselatum,* det. Signoret. auf *Caryota ursus*. Im Pflanzenhause gefunden." The collection data of this material (cf. "Cette espèce nous a été communiquée par M. le professeur Planchon, de Montpellier, qui l'a récoltée dans les serres, sur le *Caryota ursus*" in the original description of *Lecanium tesselatum* Signoret, 1873: 401); the inscription "det. Signoret," as well as the fact that Signoret described only one species of scale insect with the specific name *tessellatum,* indicate that these specimens are syntypes of *Lecanium tessellatum* Signoret, 1873.

We have selected an adult female (slide number AL-13-77c) from a series of five slides prepared from this dry material of Signoret's and here designate it as LECTOTYPE. The four specimens on the remaining four slides are designated as paralectotypes. Stages of the paralectotypes are: adult female (1); first-instar (2); and second-instar female (1). The lectotype and three paralectotype slides have been deposited in the Naturhistorishes Museum, Vienna, Austria. One paralectotype slide has been deposited in the National Museum of Natural History Coccoidea Collection, Beltsville, Maryland.

KEY TO THE STAGES OF *EUCALYMNATUS TESSELLATUS*

1. Anal plates with 1 apical seta about ½ length of body; submarginal tubercles absent ..... first-instar (Fig. 2)
– Anal plates with apical setae less than length of anal plates; submarginal tubercles present 2
2. Anal ring with 6 anal ring hairs; 1 submarginal tubercle on each side of body between spiracular furrows ..... second-instar female (Fig. 3)
– Anal ring with 8 anal ring hairs; 4 to 11 submarginal tubercles scattered over entire margin 3
3. Large discoidal pores present anterior to anal plates; numerous dorsal setae present; ventral multilocular pores present in vulvar area ..... adult female (Fig. 1)

– Large discoidal pores absent anterior to anal plates; dorsal setae absent; ventral anal multilocular pores absent ..... third-instar female (Fig. 4)

Adult Female

Fig. 1

Material studied.—Lectotype (NMVA), 1 paralectotype (USNM), 25 (AU), 4 (USNM): *Caryota urens*, Caracas, Venezuela; *Cocos nucifera*, Hilo, Hawaii; *Ficus aurea*, St. Petersburg, Florida; *Jasminum* sp., Ancon, Canal Zone; *Persea* sp., Lake Placid, Florida; *Sabal* sp., New Orleans, Louisiana; Everglades National Park, Florida; *Zingiber* sp., Cypress Gardens, Florida.

General appearance.—At maturity, derm heavily sclerotized and divided into platelike regions. Color dark brown to nearly black. Body shape ovoid to deltoid, slightly convex. Body (Fig. 1A) usually widest posteriorly. Slide mounted specimens 1691–3589 long, 922–3044 wide.

Dorsal surface.—Derm divided into platelike areas, sclerotized, with small clear areas occurring over entire dorsum, but most numerous marginally. Large irregular patterns in derm in 2 submedian rows posteriorly. Marginal setae (Fig. 1B) 17 (12–21) long, blunt to slightly fringed, usually bent posteriorly, distributed as follows: 37 to 57 between anterior spiracular setae, 11 to 18 on each side between anterior and posterior spiracular setae, 79 to 98 on posterior of body. Body setae (Fig. 1C) 8 (7–10) long, thick throughout length, usually bent, blunt apices, usually in or near clear areas between plates of derm, numerous. Three spiracular setae (Fig. 1D) in each spiracular furrow; median seta 49 (41–58) long, 6 (4–12) wide, thick throughout length, lateral setae 19 (12–26) long, 5 (4–9) wide, all setae with acute to rounded apices. Submarginal tubercles (Fig. 1E) cylindrical with inner filament, 8 to 11 present submarginally around entire body, 10 (7–11) in diameter. Bilocular pores (Fig. 1F) 1.4 (1.0–2.0) in diameter in clear areas in derm, numerous. Simple disc pores (Fig. 1G) 1.4 (1.0–2.0) in diameter scattered over dorsum, much less numerous than bilocular pores. Five to 10 larger disc pores 2.9 (2.4–3.7) in diameter anterior to anal plates. No ducts detected. Eyes submarginal on dorsum just above level of antennal scape.

Anal plates (Fig. $1H_1$, $1H_2$): Each plate triangular with acute angles; 165 (147–176) long, 75 (65–87) wide; cephalolateral margin 111 (99–124) long, caudolateral margin 113 (100–139) long. Each plate with 4 apical setae and 3 to 5 subapical setae. Anal fold with 2 pairs of fringe setae, lateral pair longer. Anal ring (Fig. 1I) notched laterally, 35 (27–43) long, 58 (49–65) wide; with 8 hairs and 2 irregular rows of pores.

Ventral surface.—Derm membranous. Ventral submarginal setae (Fig. 1J)

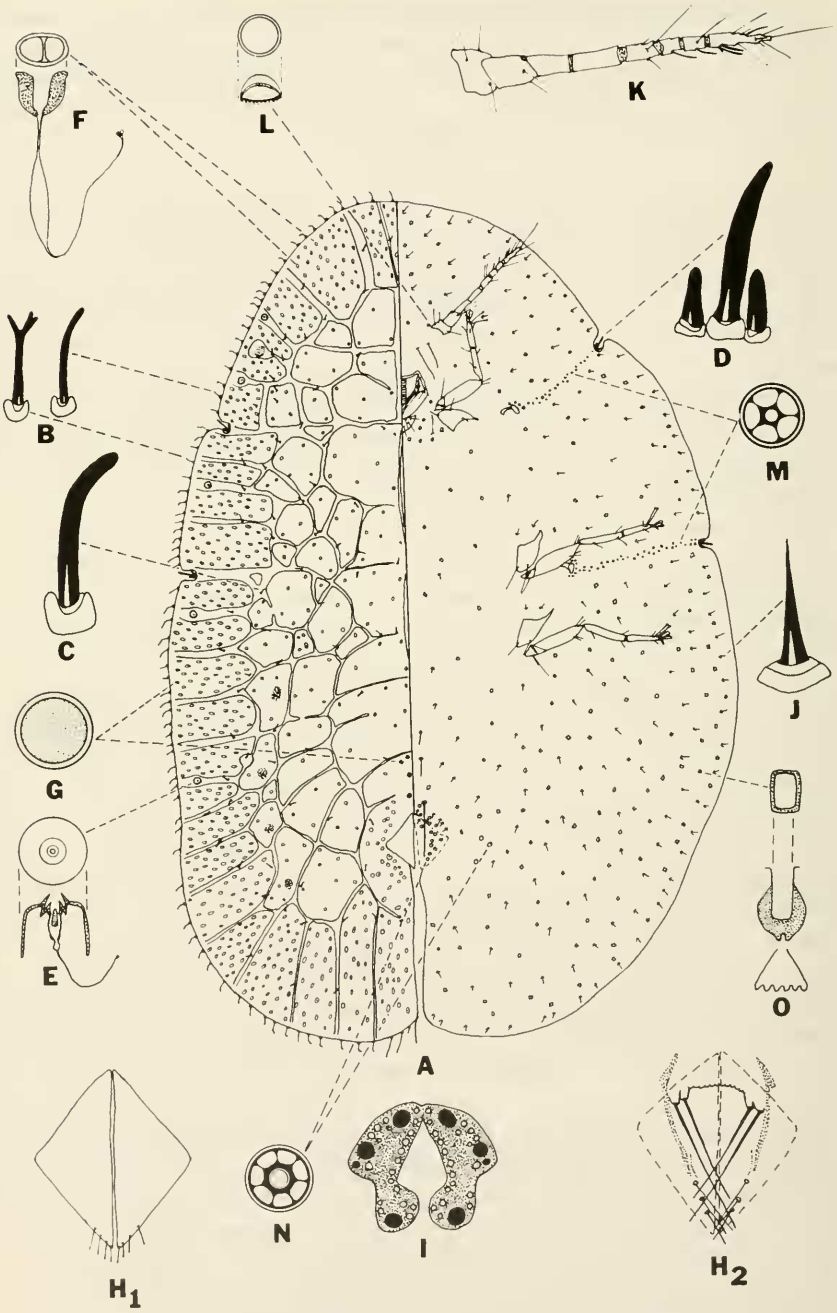

Fig. 1. *Eucalymnatus tessellatus*, adult female. See text for explanation of A–O.

7 (5–9) long, bristlelike, scattered around entire submargin. Body setae 7 (5–7) long, similar to submarginal setae, scattered over venter; 2 pairs of bristlelike interantennal setae, median pair longer; 1 to 3 setae near base of each coxa. One pair of large prevulvar setae; 2 smaller pairs of prevulvar setae anterior to large pair. Antennae (Fig. 1K) well developed, 7- or 8-segmented; total length 322 (258–363). Legs well developed, 494 (430–564) long, with tibiotarsal sclerotization and free articulation; claws without denticle; 2 knobbed claw digitules; 2 slender, knobbed tarsal digitules, extending past apex of claw. Spiracular furrows with pore band 1 or 2 pores wide; each anterior pore band with 20 to 30 pores; each posterior pore band with 25 to 42 pores. Simple conical pore (Fig. 1L) anterior to each antennal scape. Quinquelocular pores (Fig. 1M) in spiracular furrows and a few in anal area. Multilocular pores (Fig. 1N) with 6 to 10 loculi in vulvar area and a few in spiracular furrows. Microducts (Fig. 1O) scattered over entire venter. Tubular ducts not detected.

First-Instar
Fig. 2

Material studied.—2 paralectotypes, 27 (AU), 6 (USNM): *Caryota urens*, Caracas, Venezuela; *Ficus aurea*, St. Petersburg, Florida; *Jasminum* sp., Ancon, Canal Zone; *Zingiber* sp., Cypress Gardens, Florida.

General appearance.—Body (Fig. 2A) flat, elongate-oval, reddish brown, widest in middle area of body. Slide mounted specimens 353–402 long, 204–241 wide.

Dorsal surface.—Derm membranous. Marginal setae (Fig. 2B) 15 (12–17) long, pointed, usually bent posteriorly, distributed as follows: 12 between anterior spiracular setae, 2 on each side between anterior and posterior spiracular setae, 16 on posterior of body. No body setae detected. Three spiracular setae (Fig. 2C) in each spiracular furrow; median seta 12 (10–14) long, thick throughout length, lateral setae 4 (4–5) long, all setae with acute to blunt apices. Submarginal tubercles absent. Bilocular pores (Fig. 2D) in 6 longitudinal rows. Apex of head with 2 (membranous) trilocular pores (Fig. 2E). Simples disc pores (Fig. 2F) in 2 submarginal rows and 1 near each trilocular pore. No ducts detected. Eyes present on margin just above level of antennal scape.

Anal plates (Fig. 2G): Each plate elongate-triangular with rounded angles; 50 (47–56) long, 22 (15–25) wide; cephalolateral margin 30 (26–35) long, caudolateral margin 32 (27–36) long. Each plate with 4 apical setae, 3 on apex of plate, 1 in small notch on median edge of plate; median seta on apex 144 (114–161) long. Each plate with 1 subapical seta. Anal fold with 1 pair of fringe setae. Anal ring (Fig. 2H) quadrate with large lateral notch, 6 hairs and 2 rows of pores.

Ventral surface.—Ventral submarginal setae (Fig. 2I) in a row of 7 setae

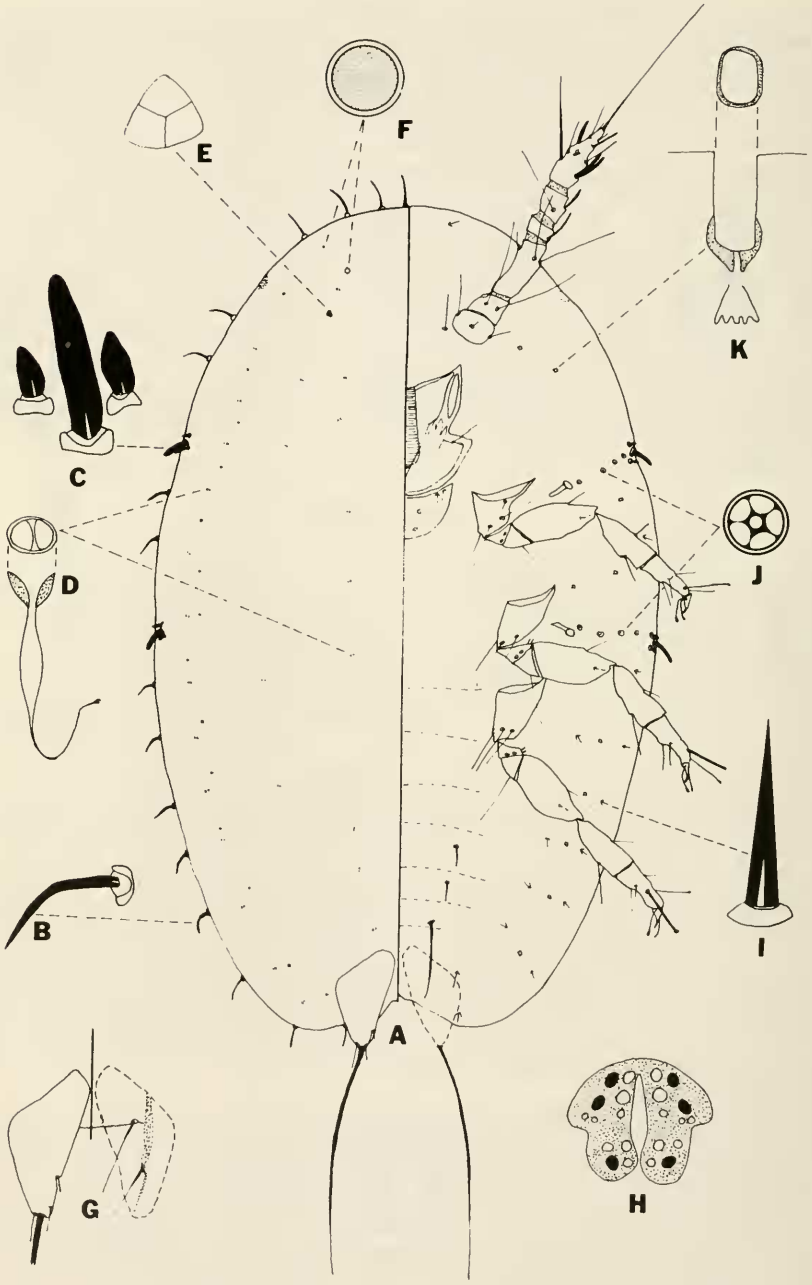

Fig. 2. *Eucalymnatus tessellatus*, first-instar. See text for explanation of A–K.

on each side of abdomen, 1 between spiracular furrows on each side of body, and 1 pair at apex of head; short, bristlelike. Body setae similar to submarginals, in a submedian row on each side of abdomen. Two or 3 large interantennal setae. Three pairs of large, posterior, submedian setae, posterior pair longest. Antennae well developed, 6-segmented, 108 (103–114) long. Legs well developed, 157 (137–172) long, without tibiotarsal sclerotization or free articulation; claws without denticle; 2 knobbed claw digitules; 2 slender, knobbed tarsal digitules, except prothoracic tarsi with 1 digitule setiform. Spiracular furrows with quinquelocular pores (Fig. 2J); each anterior pore band with 3 or 4 pores; each posterior pore band with 4 pores. Multilocular pores with 6 to 9 loculi occasionally in spiracular furrows. Microducts (Fig. 2K) between submarginal and body setae on abdomen, 2 to 4 between spiracular furrows, and 2 lateral to each antennal scape. Tubular ducts not detected.

Second-Instar Female

Fig. 3

Material studied.—1 paralectotype, 10 (AU), 4 (USNM): *Ficus aurea*, St. Petersburg, Florida; *Jasminum* sp., Ancon, Canal Zone; *Sabal* sp., New Orleans, Louisiana; *Zingiber* sp., Cypress Gardens, Florida.

General appearance.—Body (Fig. 3A) flat, oval, adhering so closely to the leaf surface as to be nearly transparent, light golden in color. Slide mounted specimens 773–1200 long, 426–742 wide.

Dorsal surface.—Derm membranous. Marginal setae (Fig. 3B) 16 (15–16) long, blunt to slightly fringed, usually bent posteriorly, distributed as follows: 16 to 20 between anterior spiracular setae, 3 to 5 on each side between anterior and posterior spiracular setae, 28 to 33 on posterior of body; a few near anal cleft much longer and hairlike, 28 (16–37) long. No body setae detected. Three spiracular setae (Fig. 3C) in each spiracular furrow; median seta 18 (16–27) long, thick, straight, with slightly rounded apex; lateral setae 10 (9–12) long with rounded to acute apices. Submarginal tubercles (Fig. 3D) cylindrical with inner filament, usually 2, 1 on each side of body between spiracular furrows. Bilocular pores (Fig. 3E) with inner filament and simple disc pores (Fig. 3F) scattered over dorsum. No ducts detected. Eyes submarginal on dorsum just above level of antennal scape.

Anal plates (Fig. $3G_1$, $3G_2$): Each plate triangular with lateral angles pointed; cephalolateral and caudolateral margins slightly concave, often notched on median margin; 72 (65–74) long, 34 (28–40) wide; cephalolateral margin 50 (43–53) long, caudolateral margin 50 (40–53) long. Each plate with 4 apical setae and 1 subapical seta. Anal fold with 2 pairs of fringe setae, lateral pair longer. Anal ring (Fig. 3H) laterally notched, with 6 hairs and 2 rows of pores.

Ventral surface.—Ventral submarginal setae (Fig. 3I) bristlelike, in 2 lon-

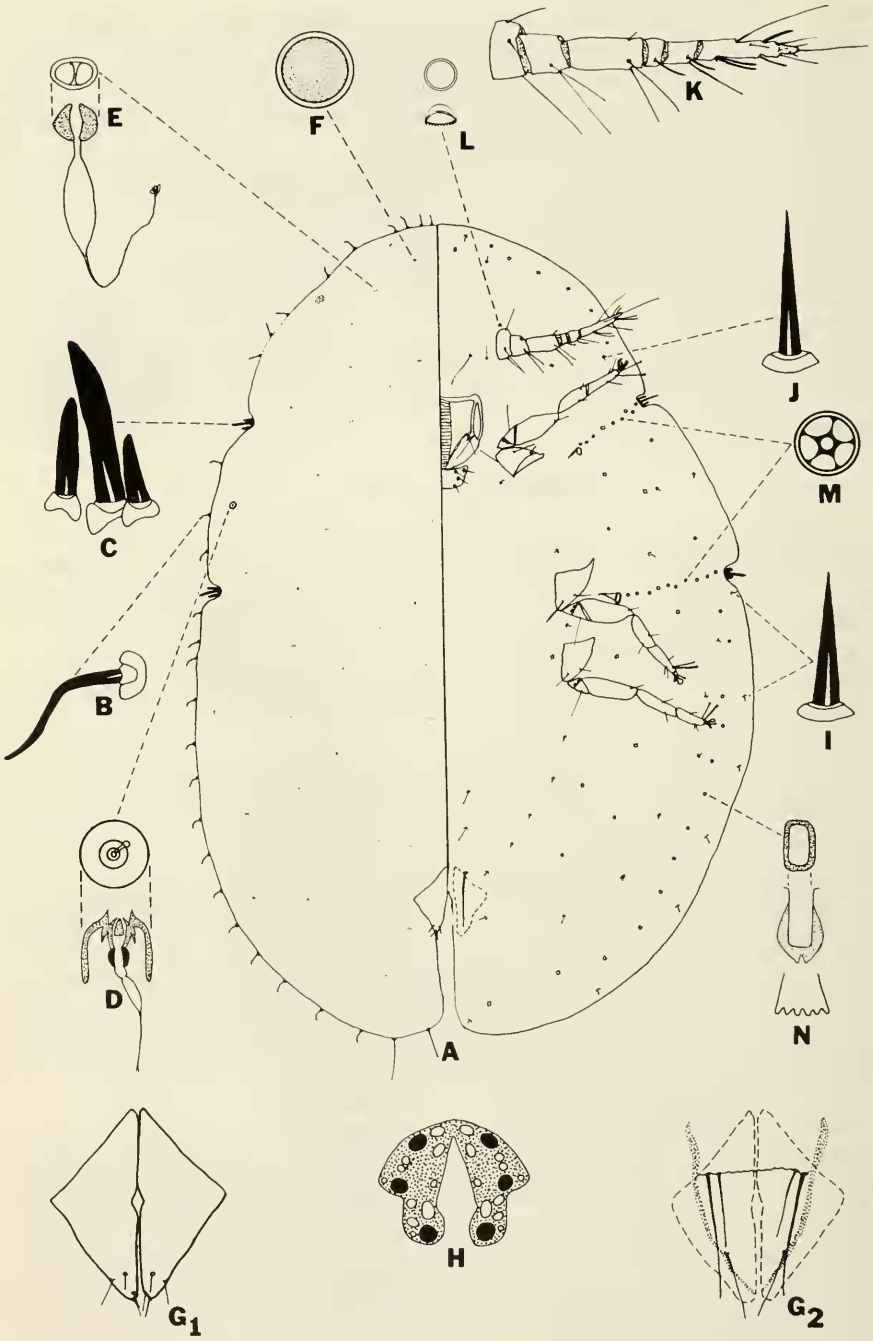

Fig. 3. *Eucalymnatus tessellatus*, second-instar female. See text for explanation of A–N.

gitudinal rows on abdomen, each row with 7 setae, 1 to 3 between spiracular furrows. Body setae (Fig. 3J) in 4 rows on abdomen and 1 seta near each coxa, shorter than submarginals, bristlelike; 2 pairs of bristlelike interantennal setae, median pair longer. Three pairs of posterior, submedian setae, posterior pair longest. Antennae (Fig. 3K) well developed, 6-segmented, 146 (136–158) long. Legs well developed, 211 (198–248) long, without tibiotarsal sclerotization or free articulation; claw without denticle; 2 knobbed claw digitules; 2 slender, knobbed tarsal digitules. Spiracular furrows with pore bands 1 or 2 pores wide; each anterior pore band with 7 to 10 pores; each posterior pore band with 8 to 12 pores. Simple conical pore (Fig. 3L) anterior to each antennal scape. Quinquelocular pores (Fig. 3M) in spiracular furrows. Multilocular pores with 6 to 9 loculi occasionally in spiracular furrows. Microducts (Fig. 3N) scattered over venter and in submarginal row around body. Tubular ducts not detected.

Third-Instar Female

Fig. 4

Material studied.—20 (AU), 5 (USNM): *Caryota urens*, Caracas, Venezuela; *Jasminum* sp., Ancon, Canal Zone; *Sabal* sp., New Orleans, Louisiana; Mobile, Alabama.

General appearance.—Body (Fig. 4A) asymmetrical, flat, ovate, adhering so closely to the leaf surface as to be nearly transparent, light golden in color. Slide mounted specimens 1299–2166 long, 804–1361 wide.

Dorsal surface.—Derm membranous. Marginal setae (Fig. 4B) 15 (12–18) long, pointed, bifid, or slightly fimbriate, usually bent posteriorly, distributed as follows: 30 to 35 between anterior spiracular setae, 7 to 11 on each side between anterior and posterior spiracular setae, 49 to 68 on posterior of body; a few near anal cleft much longer and hairlike, 28 (25–37) long. No body setae detected. Three spiracular setae (Fig. 4C) in each spiracular furrow; median seta 26 (19–31) long, thick throughout length, acute apex, often somewhat hooked in appearance; lateral setae 13 (6–16) long with rounded apices. Submarginal tubercles (Fig. 4D) cylindrical with inner filament, 4 to 7 around entire body. Bilocular pores (Fig. 4E) with inner filament and simple disc pores (Fig. 4F) scattered over dorsum. No ducts detected. Eyes submarginal on dorsum just above level of antennal scape.

Anal plates (Fig. $4G_1$, $4G_2$): Each plate triangular with lateral angles pointed; cephalolateral and caudolateral margins slightly concave; 110 (99–114) long, 52 (43–61) wide; cephalolateral margin 73 (62–93) long, caudolateral margin 78 (74–80) long. Each plate with 4 apical setae and 2 subapical setae. Anal fold with 2 pairs of fringe setae, lateral pair longer. Anal ring (Fig. 4H) laterally notched, with 8 hairs and 2 rows of pores.

Ventral surface.—Ventral submarginal setae (Fig. 4I) bristlelike, scattered around entire submargin. Body setae (Fig. 4J) scattered over body and 1 or

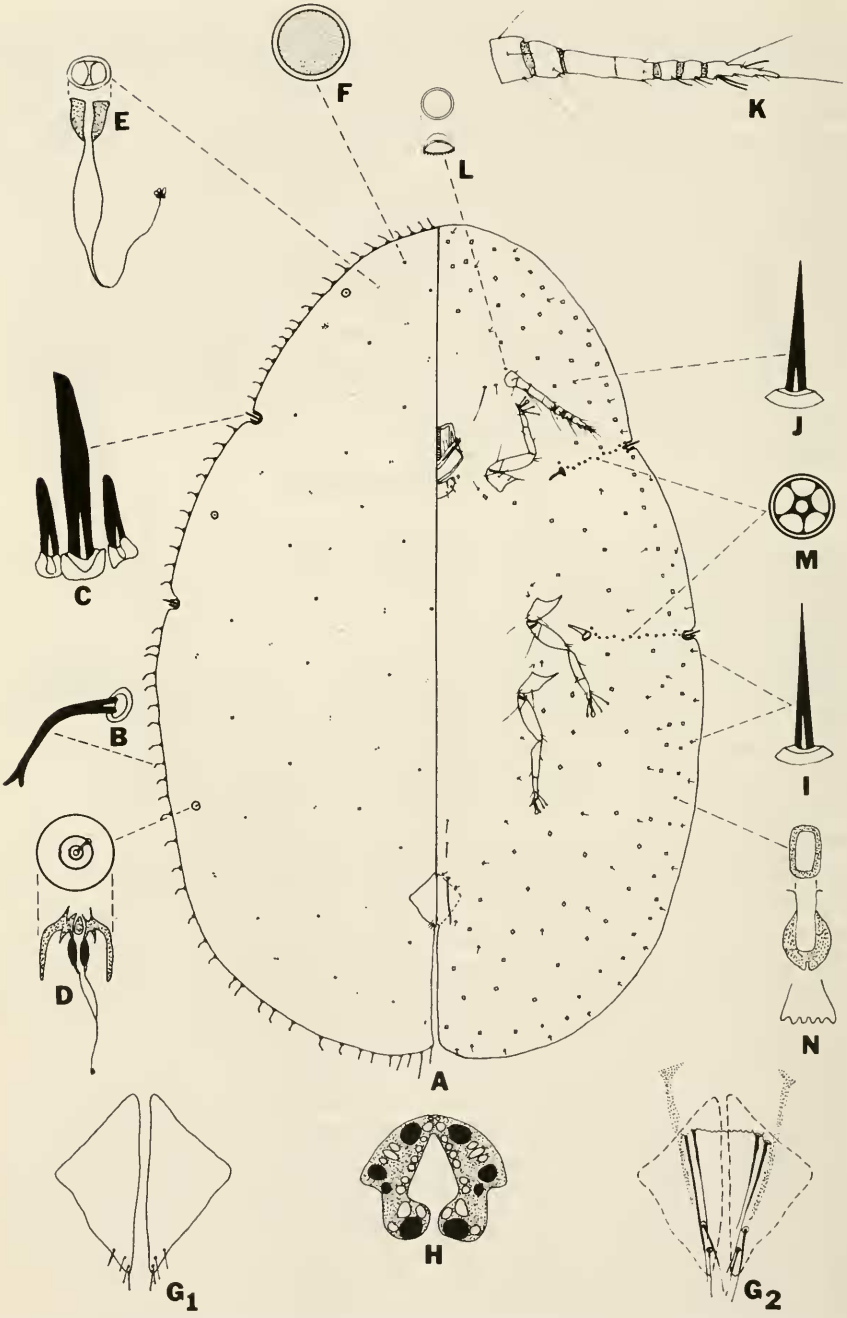

Fig. 4. *Eucalymnatus tessellatus*, third-instar female. See text for explanation of A–N.

2 near each coxa, shorter than submarginals, bristlelike; 2 pairs of bristlelike interantennal setae, median pair longer. Three pairs of posterior, submedian setae, posterior pair longest. Antennae (Fig. 4K) well developed, 7-segmented, 218 (186–260) long. Legs well developed, 311 (275–343) long, without tibiotarsal sclerotization or free articulation; claws without denticle; 2 knobbed claw digitules; 2 slender, knobbed tarsal digitules. Spiracular furrows with pore bands 1 or 2 pores wide; each anterior band with 10 to 17 pores; each posterior pore band with 11 to 21 pores. Simple conical pore (Fig. 4L) anterior to base of each antennal scape. Quinquelocular pores (Fig. 4M) in spiracular furrows. Multilocular pores with 6 to 9 loculi occasionally in spiracular furrows. Microducts (Fig. 4N) numerous over venter except for median area between legs. Tubular ducts not detected.

Discussion

Steinweden (1929) and Ferris (*in* Zimmerman, 1948) felt that *Eucalymnatus tessellatus* belongs in the genus *Coccus*, stating that the only character separating *E. tessellatus* from members of the genus *Coccus* is the hardened and tessellated derm. However, compared to *Coccus hesperidum* Linnaeus, the type-species of the genus *Coccus*, *E. tessellatus* exhibits many differences: Lack of dorsal and ventral tubular ducts, blunt to slightly fringed rather than pointed to slightly fringed marginal setae, blunt rather than pointed dorsal body setae, 8- rather than 7-segmented antennae, and a laterally notched rather than ovate anal ring. There are similarities between the two species: Possession of submarginal tubercles, two pairs of fringe setae, and eight anal ring hairs.

A final decision as to the placement of *Eucalymnatus tessellatus* cannot be made until the genus *Coccus* is revised, the immatures of *Coccus* are studied, and other species placed in the genus *Eucalymnatus* are studied.

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Literature Cited

Avidov, Z. and I. Harpaz. 1969. Plant pests of Israel. Israel Univ. Press, Jerusalem, 549 pp.

Balachowsky, A. 1927. Contribution à l'étude des Cocides de l'Afrique Mineure. Ann. Soc. Entomol. Fr. 96: 175–207.

———. 1938. Les Cochenilles de Madère (second partie). Rev. Pathol. Veg. Entomol. Agric. Fr. 25: 255–272.

Ballou, C. H. 1926. Los coccidos de Cuba y sus plantas hospederas. Cuba Estac. Exp. Agron. Bull. 51, 47 pp.

Beardsley, J. W. 1966. Insects of Micronesia, Homoptera: Coccoidea. Insects Micronesia 6: 377–562.

Bodenheimer, F. S. 1953. The Coccoidea of Turkey III. Istanbul Univ. Facult. Sci. Rev. Ser. B 18: 91–164.

Bodkin, G. E. 1917. Notes on the Coccidae of British Guiana. Bull. Entomol. Res. 8: 103–109.

Borchsenius, N. S. 1950. Mealybugs and scale insects of the USSR (Coccoidea). Akad. Nauk Zool. Inst., Tableaux Analyt. Faune URSS 32, 250 pp. (in Russian)

———. 1957. Fauna of USSR, Homoptera, Coccidae. Akad. Nauk Zool. Inst. (n.s. 66) 9, 493 pp. (in Russian)

Cockerell, T. D. A. 1893. Notes on *Lecanium*, with a list of the West Indian species. Trans. Am. Entomol. Soc. 20: 49–56.

———. 1894a. Coccidae or scale insects—IV. Bull. Bot. Dep. Jam. (n.s.) 1: 17–19.

———. 1894b. Coccidae or scale insects—V. Bull. Bot. Dep. Jam. (n.s.) 1: 69–73.

———. 1894c. A check list of Coccidae of the Neotropical Region. Trinidad Field Nat. Club J. 1: 311–312.

———. 1895. Miscellaneous notes on Coccidae. Can. Entomol. 27: 253–261.

———. 1897a. Note on *Lecanium tesselatum*. Bull. Bot. Dep. Jam. (n.s.) 4: 109.

———. 1897b. New and little-known Coccidae from Florida. Psyche (Camb.) 8: 89–91.

———. 1902. A contribution to the knowledge of the Coccidae. Ann. Mag. Nat. Hist. (7) 9: 450–456.

Cockerell, T. D. A. and P. J. Parrott. 1899. Contributions to the knowledge of the Coccidae. Industrialist 25: 159–165, 227–237, 276–284.

———. 1901. Table to separate the genera and subgenera of Coccidae related to *Lecanium*. Can. Entomol. 33: 57–58.

Costa Lima, A. 1923. Nota sobre as especies do genero *Eucalymnatus*. Arq. Esc. Super. Agric. Med. Vet. (Nictheroy, Rio de J.) 7: 35–44.

Dekle, G. W. 1973. Tessellated scale, *Eucalymnatus tessellatus* (Signoret) (Homoptera: Coccidae). Fla. Dep. Agric. Consum. Serv. Div. Plant Ind. Entomol. Circ. 138, 2 pp.

———. 1974. Key to greenhouse soft scale insects (Coccidae: Homoptera). Fla. Dep. Agr. Consum. Serv. Div. Plant Ind. Entomol. Circ. 144, 2 pp.

De Lotto, G. 1965. On some Coccidae (Homoptera) chiefly from Africa. Bull. Br. Mus. (Nat. Hist.) Entomol. 16: 175–239.

Dietz, H. F. and H. Morrison. 1916. The Coccidae or scale insects of Indiana. Indiana State Entomol. Ann. Rpt. 8 (1914–1915): 195–321.

Douglas, J. W. 1886. Note on some British Coccidae (No. 4). Entomol. Mon. Mag. 23: 77–82.

———. 1887. Note on some British Coccidae (No. 7). Entomol. Mon. Mag. 24: 21–28.

Ebeling, W. 1950. Subtropical Entomology. Lithotype Process Co., San Francisco, 747 pp.

Essig, E. O. 1913. Injurious and beneficial insects of California. Calif. State Comm. Hortic. Mon. Bull. 2, 353 pp.

———. 1926. Insects of Western North America. Macmillan Co., New York, 1035 pp.

———. 1958. Insects and mites of Western North America. Macmillan Co., New York, 1050 pp.

Ezzat, Y. M. and N. A. Hussein. 1967. Redescription and classification of the family Coccidae in U.A.R. Bull. Soc. Entomol. Egypte 51: 359–426.

Fernald, M. E. 1903. A catalogue of the Coccidae of the world. Mass. Agric. Exp. Stn. Spec. Bull. 88, 360 pp.

Gill, R. J., S. Nakahara, and M. L. Williams. 1977. A review of the genus *Coccus* Linnaeus in America north of Panama (Homoptera: Coccoidea: Coccidae). Calif. Dep. Food Agric. Lab Serv. Entomol. Occas. Pap. No. 24, 44 pp.

Green, E. E. 1904a. Coccidae of Ceylon—Pt. III. Dulau, London, pp. 171–249.
———. 1904b. On some Javanese Coccidae with descriptions of new species. Entomol. Mon. Mag. 40: 204–210.
———. 1907. XII. Notes on the Coccidae collected by the Percy Sladan Trust Expedition to the Indian Ocean: Supplemented by a collection received from Mr. R. Dupont, Director of Agriculture, Seychelles. Trans. Linn. Soc. Lond. Zool. 12: 197–207.
———. 1922. Supplementary notes on the Coccidae of Ceylon—Pt. IV. J. Bombay Nat. Hist. Soc. 28: 1007–1037.
Hall, W. J. 1923. Further observations on the Coccidae of Egypt. Bull. Egypt. Min. Agric. Tech. Sci. Serv. 36: 1–61.
Hollinger, A. H. 1923. Scale insects of Missouri. Univ. Mo. Agric. Exp. Stn. Res. Bull. 58, 71 pp.
King, G. B. 1899. Contributions to the knowledge of the Massachusetts Coccidae. II. Can. Entomol. 31: 139–143.
———. 1901. The greenhouse Coccidae I. Entomol. News 12: 231–233, 310–314.
Kirkaldy, G. W. 1902. Hemiptera. Fauna Hawaiiensis 3: 93–174.
Koteja, J. 1974. The occurrence of a campaniform sensillum on the tarsus in the Coccinea (Homoptera). Pol. Pismo Entomol. 44: 243–252.
Kozarzhevskaya, E. and J. Reitzel. 1975. The scale insects (Homoptera: Coccoidea) of Denmark. Statens Forsøgsvirksomhed I Plantekulture Beretning 1226, 40 pp.
Lawson, P. B. 1917. Scale insects injurious to fruit and shade trees. The Coccidae of Kansas. Bull. Kans. Univ. (Biol. Ser.) 18: 161–279.
Leonard, M. D. 1926. A check list of the insects of New York. Cornell Agric. Exp. Stn. Mem. 101, 1121 pp.
Lindinger, L. 1935. Die nunmehr giltigen Namen der Arten in meinem "Schildlausbuch" and in den "Schildlausen der Mitteleuropaischen Gewachshauser." Entomol. Jahrb. 44: 127–149.
———. 1943. Die Schildlausnamen in Fulmeks Wirtsindex. Arb. Morph. Taxon. Entomol. 10: 145–152.
Lizer y Trelles, C. A. 1937. Cochinillas exoticas introducidas en la republica Argentina y Danos que Causan. J. Agron. Vet. 1937: 341–362.
Mamet, R. 1943. A revised list of the Coccoidea of the islands of the western Indian Ocean, south of the equator. Mauritius Inst. Bull. 2: 137–170.
———. 1949. An annotated catalogue of the Coccoidea of Mauritius. Mauritius Inst. Bull. 3: (1)–81.
———. 1952. On some Coccoidea collected by Mr. J. R. Williams in Reunion Island. (Hemiptera.) Proc. R. Entomol. Soc. Lond., Ser. B Taxon. 21: 170–172.
Merrill, G. B. 1953. A revision of the scale insects of Florida. Bull. Fla. State Plant Bd. 1, 143 pp.
Merrill, G. B. and J. Chaffin. 1923. Scale insects of Florida. Q. Bull. Fla. State Plant Bd. 7: 177–298.
Metcalf, C. L., W. P. Flint, and R. L. Metcalf. 1962. Destructive and useful insects their habits and control. McGraw-Hill Co., New York, 1087 pp.
Newstead, R. 1894. Observations on Coccidae (no. 10). Entomol. Mon. Mag. 30: 232–234.
———. 1897. Addenda. Entomol. Mon. Mag. 33: 74–77.
———. 1917. Observations on scale-insects (Coccidae)—V. Bull. Entomol. Res. 8: 125–134.
Nur, U. 1971. Parthenogenesis in Coccids (Homoptera). Am. Zool. 11: 301–308.
Pettit, R. H. and E. McDaniel. 1920. The Lecania of Michigan. Mich. Agric. Coll. Exp. Stn. Tech. Bull. 48, 35 pp.
Quaintance, A. L. 1897. New and little-known Coccidae from Florida. II, biological observations. Psyche (Camb.) 8: 91.

Ramakrishna Aiyar, T. V. 1926. Recent additions to the Indo-Ceylonese coccid fauna, with notes on known and new forms. J. Bombay Nat. Hist. Soc. 31: 450–457.

Riddick, E. 1955. A list of Florida plants and the scale insects which infest them. Bull. Fla. State Plant Bd. 7, 78 pp.

Sanders, J. G. 1909. The identity and synonymy of some of our soft scale-insects. J. Econ. Entomol. 2: 428–448.

Schmutterer, H. 1952. Die Okologie der Cocciden (Homoptera: Coccoidea) Frankens. (pts. 1–3). Z. Angew. Entomol. 33: 369–420, 544–584; 34: 65–100.

Signoret, V. 1873. Essai sur les Cochenilles or gallinsectes (Homopteres-Coccoides). Part 11. Ann. Soc. Entomol. Fr. 42: 395–448.

Simmonds, F. J. 1957. A list of the Coccidae of Bermuda and their parasites. Bull. Dep. Agric. Bermuda 30, 12 pp.

Steinweden, J. B. 1929. Bases for the generic classification of the coccid family Coccidae. Ann. Entomol. Soc. Am. 22: 197–245.

Takahashi, R. 1928. Coccidae of Formosa. Philipp. J. Sci. 36: 327–347.

———. 1929. Observations on the Coccidae of Formosa. Part 1. Formosa Govt. Res. Inst. Dep. Agric. Rpt. 40, 82 pp.

———. 1939. Some Aleyrodidae, Aphididae, and Coccidae from Micronesia (Homoptera). Tenthredo 2: 234–272.

Thro, W. C. 1903. Distinctive characteristics of the species of the genus *Lecanium*. Cornell Univ. Agric. Exp. Stn. Bull. 209: 205–221.

Trimble, F. M. 1925. Scale insects injurious in Pennsylvania. Bull. Pa. Dep. Agric. 8: 1–21.

———. 1928. Scale insects of Pennsylvania (Homop.: Coccidae). Entomol. News 39: 42–47.

Tullgreen, A. 1906. Om Skoldloss. Entomol. Tidskr. 27: 69–95.

Williams, M. L. and M. Kosztarab. 1972. Morphology and systematics of the Coccidae of Virginia with notes on their biology (Homoptera: Coccoidea). Va. Polytech. Inst. State Univ. Res. Div. Bull. 74, 215 pp.

Wolcott, G. N. 1948. The insects of Puerto Rico. Puerto Rico Univ. J. Agric. 32: 1–223.

Zimmerman, E. C. 1948. Insects of Hawaii (Homoptera: Sternorhyncha). Vol. 5. Univ. Hawaii Press, Honolulu, 464 pp.